ISSN: 3049-2521 (O)

Volume 6 Issue I

2026

LEX AD COELUM

A Flagship Journal of

CENTRE FOR AVIATION AND SPACE LAWS

THE WEST BENGAL NATIONAL UNIVERSITY OF JURIDICAL SCIENCES, KOLKATA

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Published by: The West Bengal National University of Juridical Sciences, Kolkata

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NECESSITY AND NON-APPROPRIATION: RESOURCE USE IN SPACE SETTLEMENTS

Chelsea Raine Francek[*]

Abstract

Article II of the Outer Space Treaty is a foundational principle of space law, commonly referred to as the non-appropriation principle. It states the following: "Outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means". Concurrently, Article I of the Outer Space Treaty expresses that outer space "shall be free for exploration and use by all States". While the focus of this article is Article II, it is important to note that these provisions work together to describe the permissible access and use of outer space. This paints a picture of the drafters' intent: outer space is an area that is meant to be freely explored and accessible by all but claimed by none. A popular conversation surrounding Article II of the Outer Space Treaty concerns the use of space resources. Many scholars have addressed the question of whether the use or extraction of space resources violates the non-appropriation principle. This article will address this question as well, but in the context of imminent space activities that are geared towards the establishment of a long-term human presence in outer space, such as the development and use of space settlements. Unlike short-term space missions, which embody a temporal and discrete use of outer space, long-term presence and space settlements will likely require a 'use' which is continuous and exclusive. This article will review existing space law to determine whether this use is permissible under the current interpretation and understanding of Article II.

Keywords: De facto appropriation – Non-appropriation Principle – Outer Space Treaty – Space biotechnology – Space resource utilisation – Space settlements

Interpreting Article II and the Limits of Resource Use

Before it can be determined whether a specific use of outer space is permissible under existing international law, there must first be a discussion of what the applicable legal principle, Article II, means and how it has been implemented in practice. Article II of the Outer Space Treaty provides that outer space, including

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the Moon and other celestial bodies, "is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means". However, other provisions of the Outer Space Treaty, such as Article I, stress the freedom of exploration and use of outer space by all States. The relationship between these provisions has created uncertainty regarding the extent to which space resources may be used without rising to 'appropriation'.

The "Cologne Commentary on Space Law: Outer Space Treaty" describes Article II as a fundamental rule regulating the exploration and use of outer space. The commentators note how Article II is a significant contrast to the traditional "territorial nature of airspace" where, generally, States have complete and exclusive sovereignty over the airspace about its territory. Further, while the International Court of Justice (ICJ) has concluded that this territorial nature of airspace constitutes customary international law, the Cologne Commentary authors have affirmed that Article II and applicable state practice dictates that outer space is not to be regarded as 'territorial'. Rather, Article II was intended to reinforce the Article I principle, which emphasises 'common interest' and 'freedom', and protect outer space from territorial conflict or colonisation-driven ambitions. As such, the Cologne Commentary stresses the importance of a binding principle of non-appropriation in international space law but recognises that Article II does not explicitly resolve the question of resource extraction, leaving room for competing interpretations.

Early interpretations of Article II were largely shaped by Cold War concerns. Given the circumstances, it has been said that the original understanding of the non-appropriation principle was for it to be construed broadly under customary international law. As Abigail Pershing notes, the international community was focused on preventing the two major superpowers, the United States and the Soviet Union, from extending territorial sovereignty into outer space. There was a fear that this territorial right would promote the militarisation of outer space, such as the ability to launch nuclear weapons from these newly acquired space territories. At the time, space activities were largely state-driven and did not consider the possibility of large-scale commercial operations. Although earlier United Nations resolutions, such as those adopted in 1961 and 1962, reflect emerging principles that suggest outer space and its resources are not subject to appropriation, it would be inaccurate to fully accept that the Outer Space Treaty was "merely formalising in writing what was already customary international law in practice". Rather, Article II codified the

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developing principles. Yet, from this perspective, Pershing argues that the Outer Space Treaty was originally drafted to prevent any appropriation.

It is important to note that the drafters of the Outer Space Treaty did recognise that private actors may participate in space activities. The United States and the Soviet Union had opposing views, particularly those communistic versus capitalistic. The preparatory phase illustrated the need to achieve a balance between these views and, as a result, provisions such as Article VI were developed. Many scholars, such as Frans von der Dunk and Sandeepa Bhat, have accepted that Article VI was an ultimate clarification that non-governmental entities may engage in "national space activities", as long as States are responsible for those actions and provide the required "authorization and continuing supervision".[1] This is reinforced by the national space legislation enacted by various States, such as the United Kingdom's Outer Space Act 1986 and the United Arab Emirates (UAE) Federal Law No. (12) of 2019, which requires private actors to obtain authorisation prior to engaging in commercial space activities.

Despite the understanding that formal sovereignty claims are prohibited, there has still been a question as to whether resource extraction constitutes appropriation. In relation to the use of outer space and its resources, Stephen Gorove noted that the non-appropriation principle was "not as unambiguous as its drafters may have assumed". Gorove confidently claimed that "the phrase 'the moon and other celestial bodies' would be interpreted as the entire celestial body, including extracted resources such as mined minerals". Even though his opinion was not the majority at the time, he had the foresight to consider the involvement of private entities in space activities and warned that the non-appropriation principle was being misinterpreted, a loophole which may allow States and private actors to "lawfully appropriate any part of outer space".

Today, the understanding of Article II of the Outer Space Treaty has shifted to a much narrower interpretation. Frans von der Dunk has argued that the prohibition of appropriation does not give rise to a prohibition of commercial exploitation. Even though some scholars have discussed how Article I references the "province of all Mankind" and the 1979 Agreement Governing the Activities of States on the Moon and other Celestial Bodies (Moon Agreement) declares that the Moon and other celestial bodies are the "common heritage of mankind", this does not equate to a

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commercial ban. Von der Dunk notes how this is precisely why none of the major spacefaring nations has signed the Moon Agreement. Rather, he discusses how the "province of all mankind" reference should be equated to the high seas regime, where the prohibition on appropriation does not take away from the ability to commercially exploit resources, like fishing, as long as it is within applicable international law. Additionally, von der Dunk explains the notion of 'use' and how the current interpretation generally allows commercial use and exploitation, referencing the 'use' and operation of commercial satellites since the early 1960s. Meaning, State and private actors can now 'use' space in a way that allows the exclusive use and control of its limited yet available resources.

Von der Dunk's position is also reflected in State practice. For example, this is seen in the increase of national legislation that pertains to space resource utilisation, such as Luxembourg's Law of July 20th 2017, the United States Commercial Space Launch Competitiveness Act 2015, Japan's Act on the Promotion of Business Activities for Exploring and Developing Space Resources 2021, and the United Arab Emirates (UAE) Federal Law No. (12) of 2019. It has been noted that these domestic laws stress the importance of adherence to international law and obligations, which further aligns with von der Dunk's high seas regime comparison. By drafting and enacting such laws, countries are putting a stamp of approval on this narrow interpretation of Article II. This may be due in part because we now have the technological capabilities to extract space resources. While at the time of drafting it may have been an illusory concept, it is now something that both State and private actors can engage and profit from, whether it be for national prestige or more blatant financial gain. In 2025, the global space mining industry was valued at USD 1.44 billion and is projected to grow from USD 1.72 billion in 2026 to USD 4.07 billion by 2034. The major driver of this valuation has been said to be the increase in demand for critical metals and rare minerals. For example, minerals can be extracted from the Moon, asteroids, and Mars, which are essential for the growing technological sector and its need for renewable energy, electronic components, and the energy infrastructure to support it.

This recent shift in interpretation leads to the question of whether the non-appropriation principle's interpretation will continue to shift to accommodate emerging technologies and the activities that these capabilities allow humans to engage in. For instance, when activities in outer space shift from temporal and

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discrete, such as short-term exploratory missions, to those which are continuous and permanent, such as multiplanetary missions and human settlements on Mars, will we continue to conveniently interpret foundational legal principles to meet the growing needs of state and private actors? The next section will examine this imminent shift to determine whether a further interpretation shift is required to continue a permissible use of outer space.

The Transition: Exploration to Settlement

The interpretation of the non-appropriation principle shifted to accommodate the increase in technological capabilities. This article will now address whether a further shift in interpretation is required to accommodate the transition we are witnessing in outer space activities: from temporal and discreet, to continuous and permanent.

Beginning with the Soviet Union's Yuri Gagarin in 1961 to the more recent 2026 lunar flyby being carried out by the National Aeronautics and Space Administration (NASA) Artemis II astronauts, humans have been going to space. Not only are we exploring, but now we are planning to stay. Current space activities, missions, and priorities from both State and private actors demonstrate a clear path toward a long-term presence in outer space. For example, NASA has multiple initiatives to carry out the United States' National Space Policy, which includes building a base on the Moon. This Moon base will serve as a waypoint, establishing the infrastructure for future missions to Mars and beyond. There is even a plan to construct a nuclear power plant on the Moon, a tool which would provide the capability for mass transport into deep space. Further, NASA is focusing on improving the low Earth orbit (LEO) strategy with an "approach to avoid any gap in U.S. human presence and mature a robust commercial ecosystem", addressing the influence and critical position of private partners. The United States is not alone in these plans. Partner nations, such as Australia, have shown support for this "Moon to Mars Initiative" by creating their own parallel programs. Even more ambitious, the United Arab Emirates (UAE) has the Mars 2117 Strategy, which has a mission to build the first settlement on Mars within the next 100 years. Meanwhile, Japan, through its MMX mission, intends to develop technology which would allow return trips and communication between the Earth and Mars. This is a clear long-term, multiplanetary or interplanetary initiative. Similarly, China has spent decades

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advancing its space program, developing the Tiangong, its very own space station, and has begun to explore Mars as a second home for humanity.

These long-term missions and emerging space settlements will differ fundamentally from short-term space activities. While current capabilities, such as spacecraft and spacesuits, enable temporary travel and survival, they are insufficient for sustained human habitation. Settlements will require permanent or semi-permanent habitat structures, whether orbital or on celestial bodies, alongside integrated systems for life support and societal function. This includes closed-loop systems for recycling air, water, and waste, energy generation and storage, agricultural production, transport infrastructure, and facilities to support daily life, such as research spaces, medical care, and other institutional needs. In effect, the conditions necessary to sustain society on Earth must be replicated and expanded in space.

Emerging technologies, such as biotechnologies, will be central to this transition. For example, environmental engineering technology that utilizes algae as a biocatalyst could create an atmospheric change which makes the Martian surface conditions more habitable for humans,[2] brain-machine or brain-computer interfaces could help astronauts operate under unusual conditions and ease the complexities of long-term space flight,[3] gene editing technologies have the potential to increase resistance to cosmic radiation or enhance overall immunity to assist astronauts with the harsh environments of space,[4] or 3D bioprinting and regenerative medicine may enable long-term or indefinite missions by providing sustainable life support.

In contrast to short-term missions, space settlements will be spatially fixed, exclusive, and highly dependent on critical technologies that require continuous access and use. State and private actors involved in these ambitious endeavors will need to justify the exuberant spending of resources and energy to establish and sustain them. Not only will it practically and financially be a massive feat, but from an existential standpoint, these settlements may someday serve as a lifeboat for the human species. The challenges and risks seem insurmountable, but it is clearly not stopping us from continuing this mission of long-term human presence in outer space. With this future reality seemingly secured, it is important for us to consider not just how we can do it from a logistical perspective, but also how we can do so without violating the terrestrial law and principles that have been so carefully curated over the decades. We need to consider whether there are any international legal

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principles or regulations that either prevent or restrict us from turning these initiatives into reality. If so, is there an argument for reinterpreting these principles to accommodate the perhaps necessary scientific and technological developments that we can now practically implement?

When Does 'Use' Become Appropriation?

The previous sections have established the impending transition from human exploration of outer space to long-term presence and sustainability. As scientific and technological developments move these ambitions toward implementation, it is necessary to consider the legal and regulatory implications of these activities. This article focuses on Article II of the Outer Space Treaty, examining whether the resource use required for space settlements may amount to the appropriation prohibited under current interpretations. This section addresses that dilemma by first considering the meaning of appropriation and then reviewing relevant scholarly debates. In doing so, it seeks to identify a clearer threshold for permissible 'use' in the context of space resources and future settlements.

To begin, it is important to consider the meaning of 'appropriation'. It is commonly understood that appropriate means "to take exclusive possession of", "to set for or assign a particular purpose or use", or "to take or make use of without authority or right". In this sense, it is difficult to conceive of a space settlement that does not involve some form of appropriation. Settlements will necessarily involve physical structures, such as habitats, installations, and research facilities, that occupy physical space.[5] If they are established on the Moon or elsewhere, they are likely intended for long-term human presence, given the significant resources required for their development. This implies both a defined purpose and a degree of exclusive control by the entities responsible for their establishment.

The situation which may arise with space settlements may be referred to as a *de facto* appropriation. A recent study, referred to as the "peaks of eternal light (PEL) thought experiment", evaluates the concept of *de facto* appropriation in relation to the placement of a scientific installation on the Moon. The scientific installation considered in this experiment is a solar radio astronomy telescope to be placed in highland regions near the lunar poles because these are areas that receive a constant stream of sunlight and are almost never shadowed by other parts of the Moon. This was cited as a critical example to examine because, even if a State actor involved in

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the installation did not make a formal claim to the area where the property was located, the practical implication of the installation itself may amount to a *de facto* appropriation. The authors made this conclusion because the operation of the scientific installation addressed in the PEL thought experiment would require a continuous operation, without interruption. These factors, according to the authors, would amount to a "non-disturbance", which would effectively establish a "claim of protective exclusion and de facto appropriation". While the authors stress the importance, and perhaps duty, of scientific inquiry and discovery, they are cautious of the lack of clarity in current regulation and concerned about the possibility of "distributive injustice and resource monopolization". Importantly, this examination provides criteria that can be used to determine the threshold for when 'use' begins to amount to appropriation. A few key factors in the concluded criteria were duration of use, continuous or temporal, exclusivity, and control.

***De Facto* Appropriation: Space Settlements and Their Necessary Biotechnologies**

There is a strong case for space settlements and their required resource use amounting to a *de facto* appropriation if we apply the criteria laid out in the PEL thought experiment: duration, continuous or temporary, exclusivity, and control. First, if we consider the duration of use, the permanence element, which is firmly rooted in a settlement, makes this difficult to avoid. While there is little question that the physical infrastructure of the settlement is intended to be permanent, the resources that will be critical to sustaining the habitat itself, as well as the life within it, are also continuous. For instance, space settlements will likely require the use of biotechnologies, such as human adaptation technologies to assist inhabitants with radiation resistance and increased immunity, environmental engineering or 'terraforming' to increase oxygen, or those found in regenerative life support services, which will be critical for settlement functions such as water supply, waste management, agriculture, and breathable facilities. These space biotechnologies will be part of the critical infrastructure of the settlement, continuous and embedded in the very framework.

Further, space settlements are likely to involve forms of control that render their use functionally 'exclusive'. While existing space law does not directly regulate permanent settlements, Article VIII of the Outer Space Treaty provides that a

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launching State retains jurisdiction over a registered object, including those "landed or constructed on a celestial body". However, due to its mention of "their return" in relation to these space objects, this provision appears primarily directed towards spacecraft, satellites, and temporary missions rather than permanent civilian settlements. Similarly, Article XII addresses access to stations, installations, equipment and space vehicles, insisting that they be open to State representatives on a reciprocal basis. However, even if this right of access applies to permanent settlements, it assumes that the settlements are clearly established and operated by State actors, or at least private actors under direct State authority. Further, Article XII discusses a "projected visit" which does not interfere with normal operations. This is simply a temporal grant of limited access, one which is to be controlled at the discretion of the operating party. With that said, although existing laws and regulations do not clarify this likely future scenario, it is reasonable to assume that those who establish the physical settlements will also dictate who has access and use. This is the possibility of distributive injustice that the authors of the PEL thought experiment were referring to. As it stands, only those with the means, resources, and necessary knowledge will have the ability to 'use' the settlements, in addition to accessing the resources that sustain them and the inhabitants. This coincides with the other PEL thought experiment criteria factor of control. Those who control the settlements, the critical resources that sustain them, and the inhabitants themselves will likely control the use of the settlements, the sanctuary they may offer, and the physical area that they have occupied.

The nature of space settlements all but guarantees an exclusive, continuous, and dependent or necessary use that is susceptible to isolated control. Hence, the author argues that there needs to be further regulation, or clarification of existing law, to ensure that the transition of humans from exploration to a long-term presence in outer space, particularly through the establishment and use of space settlements and their critical biotechnologies, does not equate to a *de facto* appropriation and violate Article II of the Outer Space Treaty.

Conclusion

Science and technology will continue to advance at a rapid pace. We need to ensure that our foundational legal principles are upheld through this pace. Law needs to advance with technology, not behind or against it. We are witnessing human

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activities in outer space transition from those which are temporal and discreet, to continuous, exclusive, and permanent. As such, we need to ensure that the laws and regulations pertaining to outer space can accommodate and manage this transition. The future of space regulation needs to address the challenges, particularly those that coincide with advancements in technological capabilities, and take the necessary steps to either clearly interpret its existing legal principles or perhaps develop a novel system, which is flexible enough to accommodate long-term human settlement beyond Earth.

Notes and References:

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SUING FOREIGN STATES AFTER DEVAS LTD. V. ANTRIX CORP. LTD.

Jennifer A. Brobst[*]

Abstract

As the number of public and private space-based activities increases, jurisdictional questions and choice of law also present new options for litigants. In *CC/Devas (Mauritius) Ltd.* v. *Antrix Corp. Ltd.*, decided in 2025, the United States Supreme Court determined that a federal court could address claims related to an arbitration agreement between a private Indian telecommunications company as plaintiff and a corporation of the State of India as defendant. The Court held that the Foreign Sovereign Immunities Act of 1976, which would ordinarily immunise a foreign State defendant from liability in the United States, did not apply in this case based on its enumerated exceptions. The decision specifically addressed a geostationary satellite service contract. This article identifies several factors that may attract or deter plaintiffs considering filing a claim against a foreign State in a foreign legal system in matters regarding commercial space activities and arbitral award enforcement, with potential indirect effects on the development of other areas of space law.

Keywords: Civil liability – *Devas Ltd.* v. *Antrix Corp. Ltd.* – Foreign State litigants – Commercial space activities – International arbitration – United States Supreme Court

Introduction

In 2025, the United States (US) Supreme Court rendered a unanimous opinion in *CC/Devas (Mauritius) Ltd* v. *Antrix Corp. Ltd*. (*Devas*), interpreting the Foreign Sovereign Immunities Act of 1976 (FSIA) and the scope of immunity from suit for foreign State defendants. The case centered on litigation addressing arbitration for breach of a satellite-leasing agreement between Devas, a privately-owned telecommunications company in India, and Antrix, a government-owned corporation supporting India's Space Programme. The 2005 leasing contract would allow Devas to obtain satellite capacity from a new satellite network that Antrix would place into geostationary orbit, so that Devas could provide expanded broadcasting services for television and the Internet throughout India. However, in

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2011, before Antrix launched the satellites, it terminated the commercial agreement with Devas purportedly to expand its own satellite capacity for government purposes, resulting in a contentious arbitration award through the International Chamber of Commerce awarding damages to Devas.

In the litigation that followed, Devas eventually sought to confirm the arbitral award in the courts of other nations as binding and enforceable, under the United Nations (UN) Convention on the Recognition and Enforcement of Foreign Arbitral Awards of 1958 (New York Convention), such as in The Hague Court of Appeals in The Netherlands in 2024. In the US, FSIA's immunity exceptions were interpreted more broadly by the US Supreme Court than they had been before, precluding application of sovereign immunity in *Devas*. As international cooperation and foreign investment are integral to a thriving commercial satellite industry, both implied waiver of immunity through the presence of arbitration clauses[1] and statutory exceptions to immunity through public-private partnerships and commercialisation[2] invite such an expansion of foreign jurisdictional access.

Foreign State Defendants and Governmental Immunity in US Courts

As a potential litigant in matters of commercial space activity, the State remains subject to space object registration requirements and International Telecommunication Union (ITU) representation, and in many cases, a State remains the only entity that has "the necessary resources to meet the liability" of injury to person or property.[3] Any space-faring State would proceed with caution under this legal framework, particularly if international arbitration is expressly or impliedly agreed upon by the parties,[4] and the political status of the international space industry remains in flux.

For example, despite continued plans to exploit resources in the cosmos, it is notable that the US Congress in 2017 opted not to pass the proposed American Space Commerce Free Enterprise Act, which would have selectively transferred oversight to space activities to the Department of Commerce, nor did it pass the Space Exploration, Development, and Settlement Act of 2016, which would have promoted human settlement in space "and a thriving space economy." But the legal landscape shifts, as the US President issued Executive Orders in 2025 affirmatively promoting the commercial space industry, while the current EU Space Act proposal seeks to coordinate and regulate "space services." Irrespective of politics and

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sovereign immunity, nation-States as parties remain at the forefront of evolving civil liability and dispute resolution schemes in both international and national space law.

Nonetheless, in the interests of comity, and as a matter of customary international law, foreign States and their agencies or instrumentalities would ordinarily enjoy immunity from suit in other nations.[5] In the US, under 28 U.S.C. § 1602 et seq., FSIA provides such immunity. However, the Act also serves as the sole statutory basis for obtaining jurisdiction over foreign States in US federal courts if an exception applies, such as contractual waiver or commercial activity with a sufficient nexus to the US, under 28 U.S.C. § 1605(a)(1)-(2).

In *Devas*, subsequent to complex judicial proceedings in India, the US Court of Appeals for the Ninth Circuit reversed the decision of the US District Court, holding that personal jurisdiction under FSIA had not been established due to a lack of minimum contacts with the US. However, the US Supreme Court reversed the Ninth Circuit decision and remanded the case, holding, as a matter of statutory interpretation, that FSIA's text incorporates its own personal jurisdiction contacts within its subject matter jurisdiction text. Specifically, FSIA's immunity exception under 28 U.S.C. § 1605(a)(6) applied, authorising original jurisdiction for judicial confirmation of an arbitration agreement between a foreign State and a private party "concerning a subject matter capable of settlement by arbitration under the laws of the United States." Importantly, the Supreme Court's expansive interpretation of personal jurisdiction in *Devas* would apply to any of the FSIA exceptions. Thus far, only one federal court has mentioned the Supreme Court holding in *Devas*, and it does not involve a commercial dispute or an arbitral award.[6]

Space law has, for decades, emphasised mutual voluntary cooperation among nations, such as promoting the formation of agreements between States related to the use of governmental or commercial satellite broadcasting technology,[7] but this has come with the cost of litigation. Many exceptions to sovereign immunity in the US under FSIA, or in other jurisdictions, such as the United Kingdom, European Union, or Australia, have been tied to commercial activities, although initially observers noted that "[i]mmunity for actions *iure imperii* remains unquestioned."[8] For example, tort liability in international and national space law may create State accountability, such as in the Liability Convention under international space law.[9] Yet, as a matter of customary international law, a State is usually sovereign only

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"within its own territory,"[10] although the UN maintains a permissive approach to nonconsensual remote satellite sensing of a foreign "sensed State."[11] The tension between maintaining the integrity of sovereign autonomy amid the growing interdependence of nations is reflected in the commercial space industry, as well as other international activities that may support exceptions to sovereign immunity.

In the US, additional FSIA exceptions permitting suits against foreign States include State acts constituting violations of international law with respect to "culturally significant works" under 28 U.S.C. § 1605(h). Also, in 2008, Congress enacted 28 U.S.C § 1605A, the terrorism exception to jurisdictional immunity of a foreign State, which generally provides that foreign States that sponsor terrorism may be sued for money damages in American courts of law by the US government, military, or by an American national in a private right of action. Here, acts of terror expressly include acts of torture, hostage taking, aircraft sabotage, or extrajudicial killing, and *Devas* would ease jurisdictional constraints.

Qualifying Harmful Acts by a Foreign State

Despite their economic impact, the enforcement of foreign arbitral awards for breach of contract is far less provocative than some other areas of litigation involving State actors. Arbitration itself reflects a mutual interest in settlement and non-violence, which comports with the historic policies of international space law. The Outer Space Treaty of 1967 frequently obtains new State signatories and puts forth a common rights' regime recognising the essential need for cooperation and benefit to humanity, where hostile conquest and acquisition in space are unacceptable. More recent agreements, such as the non-binding Artemis Accords related to resource extraction, the collaboration between China and Russia to establish a lunar-based nuclear power plant, and the global split regarding International Space Station cooperation, put forth a less robust vision of a cooperative commons in outer space for humanity as a whole.[12]

What constitutes "space law" is beyond the scope of this discussion, but the commercialisation of space begins on Earth, including contractual matters and even perhaps more mundane operational matters.[13] *Devas* involved a contractual dispute over property rights to use of geostationary satellite systems, but if a civil legal action involved directly hostile conduct, such as malicious satellite interference or sabotage of lunar mining, the question arises whether another nation's legal system could

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feasibly offer a useful forum to litigate the claim. At minimum, in a satellite diffuse world in which most satellites in orbit are commercial, preventative measures, such as mandating satellite launch impact assessments, cost-benefit-risk analyses, reduced emissions, and public submission processes, are now examples of legal measures recommended by scholars.[14] Avoidance of litigation is also possible through internal domestic legislation offering preventative measures, such as the Federal Communications Commission regulations adopted in tandem with the Orbital Debris Mitigation Standard Practices in 2020 in the US.[15]

In more political international matters, a court may opt not to recognise its jurisdiction even if an exception to sovereign immunity would permit a foreign State to be sued. For example, in *Aviation & General Insurance Co., Ltd.* v. *U.S.*, the US Court of Federal Claims held in 2016 that plaintiffs' constitutional claims against Libya would be dismissed after the US President had settled all claims following certain terrorist activity. The Court noted that the President has, since 1799, lawfully exercised the right to settle international claims in the interests of amity and peaceful international relations, while "[a] number of practical, legal and political obstacles have made it all but impossible for plaintiffs in these [FSIA] terrorism cases to enforce their default judgments." Two months after the Court issued its decision dismissing the FSIA claims in *Aviation & General Insurance*, Congress enacted 28 U.S.C. § 1605B, amending FSIA yet again, but now more narrowly permitting claims for money damages to proceed against a foreign State for acts of international terrorism, at least symbolically.

In the absence of clear authority or jurisdictional boundaries, such as the high seas or Antarctica, governments have deferred to their own law or devolved into unresolved debate.[16] For example, in 1979, when considering whether US Presidential power authorised the unilateral termination of a treaty, such as the Outer Space Treaty, a dissenting justice of the Court of Appeals of the District of Columbia remarked that acting alone without Congressional approval would be "magnified into a truly awesome power and a dangerous precedent."[17] Here, the US Supreme Court ultimately held the political question was unripe for judicial adjudication. In 2025, the US Court of Appeals for the Second Circuit held in *Havlish* v. *Taliban* that "the FSIA emphatically does *not* charge the Judiciary with the threshold power to determine whether the basic legal existence of a foreign state is *recognized*, especially in contravention of the Executive." Thus, at times, any nation must consider

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whether a court of law is the proper forum at all, including matters affecting space activities among nations.

Strategies for Space-Based Claims in Domestic Courts

In *Devas*, foreign investment incentivised the use of the courts in the US and many other nations to confirm an arbitral award related to breach of a satellite contract. More broadly, whether claimants would file commercial space-related claims in a foreign court is clearly a question of legal strategy, assuming an exception to sovereign immunity exists. Several factors might be worth considering, as demonstrated below.

First, claimants are more likely to demonstrate a sufficient nexus to jurisdictions with primary space programmes around the world, including those which have extensive commercial space activities and launch sites.[18] In 2021, for example, it was reported that 93% of the 1,309 space launches occurred in the US, of which 81% were Starlink satellites launched by the private company SpaceX. However, there is substantial international cooperation across the globe in the space industry, with rocket and satellite launch sites in nations on every continent.

Second, the judicial branch and legal counsel in primary space-faring nations are also more likely to be familiar with the needs, benefits, and risks of international commercial space activities. Of course, some space-based civil claims, such as damage caused by falling debris from spacecraft or humanitarian concerns,[19] require less specialised knowledge to understand the harm that may occur anywhere on the planet.

Third, the stability and transparency of a nation's legal system and dedication to the rule of law will be relevant to filing a claim in that jurisdiction, even if a sufficient nexus for personal jurisdiction can be established. Undoubtedly, public trust is essential for the rule of law and frequently plays out through the familiar processes of the judicial branch.[20] This may be tempered, of course, by fluctuating international relations and the power of the executive or legislature to restrict or otherwise affect judicial action as a matter of public policy. However, if nations are willing to adjudicate space-related claims involving foreign parties or States, a degree of legal innovation may prove beneficial as technological development continues in the commercial space industry.[21]

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Conclusion

International arbitration remains a key form of dispute resolution among States in the absence of a designated international space tribunal. Indeed, the commercial space sector demonstrates through arbitration that exceptions to sovereign immunity permit government actors and private parties to settle disputes and ensure the enforcement of judgments with a degree of international trust. In cases such as *Devas*, major government satellite contracts are shown to involve complex domestic and foreign investment, such that the need for judicial confirmation of arbitral awards in multiple nations is inevitable.

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EU'S SPACE REGULATORY TURN AND INDIA'S POTENTIAL CHALLENGES

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Abstract

The commercialisation of outer space, coupled with the growing involvement of private actors, has fundamentally transformed the legal and policy landscape once shaped by Cold War rivalries. The NewSpace Era has seen multiple significant developments, including the Artemis Accords and the ILRS initiative. Against this backdrop, the recent European Union Draft Space Act represents a disruptive regulatory intervention, seeking to harmonise safety, resilience, and sustainability standards across the Union's internal market. The article examines this regulatory shift and its broader implications for global space governance, with a particular focus on India. By situating the Draft Act within the cross-border nature of contemporary space activities, the article traces the pattern of asymmetry in the space governance frameworks and identifies the challenges this poses for India while outlining a potential way forward.

Keywords: Artemis Accords – EU Draft Space Act (Draft Act) – Global South – Regulatory challenge – Space governance – Space Policy 2023

The Politics of Outer Space: Then and Now

Since the launch of Sputnik 1 in 1957, the world has witnessed a rapid expansion in the deployment of satellites and other space objects. As of June 2026, approximately 12,000 satellites orbit Earth, and their numbers continue to rise to keep up with the escalating demand for space and space-based services. From essential functions like telecommunications, weather monitoring and disaster management, to leisurely activities involving luxury sub-orbital flights, space has become an integral part of everyday life.

The reliance on space services coupled with the liberalisation of economies has facilitated cross-border investments in the space industry, dramatically advancing technological developments and significantly lowering the cost of accessing space. This has gradually transformed the space sector into a critical component of global

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and national economies, with projections estimating its value at $1.8 trillion by 2035. This exponential growth can be traced to the entry of private players into a domain once monopolised by States, shifting the focus from State security to commercialisation and innovation.

Nevertheless, the status quo of exploration and use of outer space being 'the province of all (hu)mankind' remains undisturbed as interactions and affairs in the domain largely rely on international legal frameworks and cooperation between States. This unique nature of space makes it inseparable from diplomacy, power and politics. Even the much-hailed understructure of international space law, the Outer Space Treaty (OST) was born out of a political compromise between the United States and USSR during the Cold War détente. Over the past seven decades, international efforts have yielded five multilateral treaties (with the Moon Agreement having the least number of ratifications) and numerous soft law instruments. However, the NewSpace era has triggered a race among the States to reshape and dominate the emerging space politics in the pursuit of setting standards for the exploitation and use of outer space and its resources.

The race has intensified since the United States unveiled the Artemis Accords in 2020, establishing bilateral partnerships that outline non-binding commitments to implement a practical set of principles, guidelines, and best practices for carrying out space activities, intending to increase safety and promote sustainability. Simultaneously, China and Russia, along with their partnerships with allied States, launched their roadmap to dominate lunar politics through the International Lunar Research Station (ILRS) initiative. A recent addition to these ever-escalating astropolitical developments is the introduction of the Draft EU Space Act, indicating Europe's long-term aspirations.

Throughout this article, the authors argue that the space industry, unlike other transnational ventures, has an added layer of complexity primarily arising from the nature of operations. Thereby requiring additional coordination between States, as a mere domestic or internal market regulation would not just affect the cross-border trade but also generate ripple effects on space operations and investments in assets located in outer space. Further, in the upcoming section, the authors examine the asymmetry in global space policy and the traceable pattern of regulatory burdening by developed nations on developing nations that results in restricting market access.

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In the final sections, the authors focus specifically on the implications of the proposed EU regulation on India and outline the potential pathways forward.

The EU Space Act and the International Response

With the third largest share of the global space economy, only behind the US and China, the EU has been consistently working towards expanding its ambitions in space. The Union has channelled this drive into a dedicated EU Space Programme in conjunction with its Space Policy and has strengthened coordination with the European Space Agency (ESA) through the Financial Framework Partnership Agreement (FFPA). This momentum extends beyond EU institutions themselves; the ESA member states recently made a budgetary commitment of nearly 22.3 billion Euros ($25.63 billion) at the Ministerial Council of the European Space Agency (ESA), underscoring Europe's collective determination to strengthen its technological capabilities and global competitiveness in the space sector.

As part of its legal and regulatory push, the Union introduced, on 5 June 2025, the draft proposal for an EU regulation for safety, resilience and sustainability of space activities in the Union (hereinafter "Draft Act"), inviting mixed responses from policymakers and industry actors influenced by *realpolitik* considerations. After further comments, the updated proposal was released in the public domain on 5 December 2025 and a " Presidency Compromise Text" in April 2026. The Draft Act is an ambitious and comprehensive piece of regulation addressing nearly all contemporary aspects of space governance. More than just a piece of law, it goes on to conspicuously declare itself a part of initiatives to advance the Union's political agenda and its trajectory towards digital and green transitions.

The Draft Act appears to have circumvented Article 189 of the Treaty on the Functioning of the European Union (TFEU), which expressly prohibits the harmonisation of laws and regulations of the member States of the Union. It draws its entire competence from Article 114 of TFEU by trying to set unified standards for the establishment and functioning of the internal market in space services and space-based data, where there could be conflict and fragmentation of laws amongst member States regarding safety, resilience and sustainability. Since it excludes from its scope any provisions regarding obligations of launching States, liability of operators, use of space resources, insurance and other related aspects, in the long run, this may potentially conflict with Article 189. The legal basis and the broad

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scope of the Draft Act could become questionable when the Member States exercise their competence to regulate other areas of the space sector.

Although an internal market regulation, the long arm provisions of the Act can extend extraterritorially to third-country operators. This application risks stifling the growth of the sector across jurisdictions. Article 15 of the Draft Act makes it necessary for third country operators to comply with safety, resilience and sustainability regulations at par with Union operators, unless a decision of equivalence under Article 105 is provided or a derogation is permitted. With regards to safety and technical requirements, the revised text of the Draft Act retains the provisions in essence from earlier versions without much amendments, despite heavy criticism from multiple fronts. Article 15 of the Draft Act mandates subscription from a collision avoidance provider for even third-country operators. Further, Article 63 obliges the third country operators to ensure traceability, either by possessing the technical means or by relying on external sources, while Annex IV stipulates extensive technical requirements for collision avoidance.

The EU has been particularly keen on sustainability measures, and the Draft Act carries forward the momentum. It harmonises the space sector activities with the Sustainable Products Regulation and Circular Economy Action Plan Framework, optimising through mandating a standardised environmental footprint calculation method. The data would be fed to the Union's database and would be made part of the Life Cycle Assessment (LCA) for space activities. While there has been no consensus in the international sphere regarding debris, the Draft Act, in its Article 70 and Annex V, lists out detailed rules and measures to be taken for debris mitigation. The framework incorporates both software and hardware resilience along with cyber hygiene practices. These measures have been taken to ensure compliance with the goals of the EU's NIS 2 Directive and the Cyber Resilience Act.

Despite its attempts to ease difficulties, the Draft Act, throughout its text, micro-regulates and complicates implementation by establishing numerous administrative bodies and bureaucratic procedures. Further, the Draft Act attempts to employ law as guidance for developing technology (Article 109), an approach that in the long run would be beneficial for sustainable expansion, but an early adoption in emerging areas, like in orbit servicing, could potentially stifle innovation. Thus, it burdens the private players through overregulation and increased compliance costs. Additionally,

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the Act aims to propose hard standards for debris mitigation, environmental sustainability, data and cyber security, not just for the Union space operators but also for non- EU operators interacting with the EU market, disturbing the current international best practices in the area, such as IADC Debris Mitigation Guidelines.

Unnecessary Regulatory Burden

While National Treatment (NT) is a binding general obligation under GATT, Market Access (GATS, Art. XVI) and NT (GATS, Art. XVII) are specific commitments that apply to sectors listed in a country's Schedule and only to the extent of limitations in the Schedule. Space services are not categorised as a standalone sector under GATS, rather they fall under proximate subsectors like telecommunications, IT, engineering, digital services etc., depending on the content of the service. Therefore, measures affecting these subsectors have a consequence on space services and vice versa.

For instance, satellite-based internet services fall under basic telecommunications services. The Draft Act deems an electronic communications provider that operates or controls a satellite or performs launch operations to be a "space operator" (Recital 17e), thereby imposing additional compliance burden in a committed sector for basic telecommunication services. For such reasons and also for explicit "Giga Constellation" categorisation, the United States has come down heavily on the Draft Act, criticising it as unacceptable and specifically biased against US operators of large constellations like SpaceX. However, the US itself, through its Orbital Debris Mitigation Standard Practices as part of Federal Communications Commission (FCC) licensing conditions, has created barriers for foreign operators, similar to the Draft Act. Further, Earth Observation and SSA services offered by startups typically fall into telecommunication and/or computer-related services (data processing services), both committed sectors to which NT obligations apply. As per the Draft Act, these startups operating a few to a fleet of small satellites become "space operators" subject to full compliance. However, relaxations are granted through a light regime for environmental compliance under Article 101b to Union SMEs but denied to third-country operators, irrespective of size.

States may regulate through technical standards and licensing requirements, but must ensure that such measures are reasonable and not more burdensome than necessary.

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Although these initiatives *prima facie* seem harmless and proactive, they directly constrain the capacity of developing countries to enter the EU market. Even though these measures are being introduced to secure the EU's space infrastructure and competition in the internal market, the regulations increase the cost of compliance for third country operators. Given that most private players from developing countries are start-ups or Small and Medium Enterprises (SMEs), they are disproportionately burdened by such unilateral regulatory changes and could adversely impact the developing countries on the path to setting foot in space ventures and making space and orbital economies work for them.

India's Strategic Position and the Fragmenting World Order

The consequences of overregulating an industry having cross-border implications can be far-reaching for all nations, including India, which is on the track of becoming a dominant space power. SatComm India Association's roundtable on the proposed EU Space Act, followed by their joint response to the European Commission, was prompt in highlighting the concerns of non-EU entities engaged in space services and recommended proportional and predictable oversight. While a significant number of EU States and India are part of the Artemis Accords, such a unilateral standard-setting by the EU further fragments international practice. Beyond Artemis, such regulatory unilateralism makes States embrace protectionism, ultimately undermining market competition and commitments of non-discrimination in international trade, especially in the context of the current geopolitical climate.

Amidst this, the EU and India have concluded negotiations on the much-hailed 'Mother of all Deals', the EU-India Free Trade Agreement (FTA), which aims to reduce trade barriers and to create positive prospects for bilateral trade. Yet for the growing Indian space sector, exporting goods and services largely depends on the EU's equivalence decisions and cooperation agreements with third countries under Article 105 of the Draft Act. While space has been identified as a key sector by the political guidelines for the European Commission 2024-2029 and the Draghi Report on the future of European competitiveness, the Draft Act further strengthens data and security compliance alongside mechanisms for aligning sustainably with the Carbon Border Adjustment Mechanism (CBAM), reflecting the sector's criticality. However, these unreasonable regulatory burdens may increase compliance costs,

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constitute non-tariff barriers that restrict market access and may also prove to be anti-competitive. Regulatory frameworks established by dominant space powers have often served the consolidated interests of the Global North, reinforcing structural inequalities that have consistently disadvantaged the Global South. Jakhu[1] notes that the export control regulations by the United States have been leveraged to limit and restrict access to technology. On the other hand, regulations have been used to justify this attitude to "protect" the world from "irresponsible users". The EU Draft Act risks perpetuating a similar dynamic, where it effectively forecloses meaningful market participation by emerging space actors.

Despite India's strong partnerships with various States and trade blocs, it does not completely integrate with any, placing it in a position where it heavily relies on homegrown innovation and advancements. Once known for its frugal engineering, India has since surpassed expectations and has ventured into more complicated aspects of space services today, including Space Situational Awareness (SSA), the development of orbital data centers and on-orbit servicing capabilities. These advancements reflect the country's concentrated efforts to foster a flexible regulatory environment and a startup driven growth model through enthusiastic funding initiatives. Over the decade, the government's expenditure from the public exchequer for space activities has gradually increased to facilitate this. While innovation within the sector is persistent, it is imperative for India to translate its coordinated efforts into tangible outcomes.

Legislative and Regulatory Preparedness of India and the Way Forward

India's engagement with and investments in space ventures date back to the 1960s, and it was one of the first nations to be part of the Outer Space Treaty negotiations. Decades later, the space market has grown considerably, but the legal architecture has struggled to keep pace with these developments. The introduction of the Space Bill in 2017 was a significant attempt to create a unified framework, but unfortunately, it did not see the light of the day. Subsequently, in 2023, the government laid out its roadmap through the introduction of the Space Policy. While it was not a legislative instrument, it marked a significant administrative step forward.

However, there have been certain concerns. The IN-SPACe, which is an autonomous agency under the Department of Space (DOS), was established prior to the authorisation via the Space Policy of 2023. A retrospective authorisation

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appears to have been later granted through the space policy to confer legal sanctity, but nevertheless lacks legislative backing. Later, akin to the Space Policy, Norms, Guidelines and Procedures (NGP) of 2024 was introduced to operationalize the policy through regulatory mechanisms. Meanwhile, other aspects like data security, intellectual property and company establishment have been addressed in fragmented law and policy frameworks.

These gaps and inconsistencies in legal and policy frameworks underscore a structural deficiency that would limit India's ability to respond to and effectively engage with the evolving legal landscape of the space sector. Thus, it is high time that India enacts a space legislation that cures inconsistencies and prepares for a global engagement. The much-awaited space legislation has to achieve multiple objectives simultaneously. The Act should be able to consolidate the fragmented framework, provide legal certainty to attract investors, ensure compliance with international obligations, and remain flexible to absorb the developments in a rapidly changing domain. Striking this balance is not just necessary for governance but is imperative to India's position in the emerging global space sector.

Unlike the EU Draft Act's emphasis on law to guide technology, India, which is on the path of enacting its Space legislation, should introduce an umbrella enactment that is adaptive to evolving trends in the sector, and delegate through rules and regulations. Rather than focusing exclusively on developed spacefaring nations, inspirations can be drawn from emerging space actors vying to expand, such as Kenya. The Kenyan Space Bill of 2024, which is currently under public consultation, is a carefully crafted piece of legislation that leverages the country's geographical (its equatorial location) and strategic advantages while adhering to best practices relating to long-term sustainability (Sec.6 r/w Sec.23), space navigation (Sec. 24), weather monitoring (Sec.25) and accepted deorbiting plans (Sec. 23). The Bill also aims to attract foreign investments and promote the growth of its domestic industry, with a particular focus on launching and earth observation services.

While a new law can lay a foundation for governance, it cannot serve as a panacea for all challenges. The realisation of future benefits from the opportunities created by the FTA must be bolstered through effective diplomacy and robust regulatory compliance that India and its space sector must actively undertake. While India's space industry is currently dominated by start-ups steadily investing in innovation

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and research and development, it is equally important to invest in compliance frameworks, trained professionals with domain expertise and sustained collaboration with academia in the areas of regulatory policy, international law and geopolitics.

On the flip side, it is equally essential for India to position itself at the forefront of international rule-making and standard setting, advancing an agenda which serves in the best interests of not just the Indian space industry but also broader interests of the contributing citizenry of the public exchequer. It is imperative that our expanding base of start-ups and private players are ensured that their legitimate expectations of free and fair access to global markets are not curtailed by regulatory barriers, enabling them to realise their optimum potential.

Notes and References:

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EVALUATING INDIAN SPACE POLICY 2023 IN LIGHT OF INDIA'S OBLIGATIONS UNDER THE MOON AGREEMENT

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Abstract

This article evaluates the Indian Space Policy (ISP) 2023 against its obligations as a signatory to the Moon Agreement. It contrasts the private sector resource-extraction narrative under the ISP with the principles embodied in the Moon Agreement. India's obligations as a signatory to the Moon Agreement under Article 18 of the VCLT, the ISP's position on resource extraction and commercialisation, and how these would interact with the Moon Agreement's object and purpose are examined. The lack of a legislative framework behind the ISP also forms an incidental part of the discussion.

Keywords: Artemis Accords – Common Heritage of Mankind (CHM) – Indian Space Policy (ISP) – Space Mining – VCLT

Introduction

India has seen significant progress in the space sector and introduced the ISP in 2023 to guide space activities and promote private-sector participation. It primarily attempts to streamline administrative processes, but still suffers from the absence of a law. The legislative vacuum questions India's compliance with international obligations regarding the authorisation and supervision of space activities. The ISP addresses private actors' rights of possession and ownership over commercially recovered space resources in Clause 4(13). This has been criticised for moving towards alignment with the United States' position. Through the United States-led Artemis Accords, space mining and resource extraction rights have gained prominence economically and legally. The Artemis Accords, which has garnered 67 signatories, including India, calls for cooperation in outer space resource utilisation. India is a signatory to both the Outer Space Treaty and the Moon Agreement, but has not ratified the latter. The declining acceptance of its provisions by major space-faring nations has been explored in detail by the scholarly diaspora, making India's

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obligations under the Moon Agreement considerably less discussed in the context of international relations.

Obligation to Authorise and Supervise

The ISP suffers from an inherent limitation in the absence of legislative backing. India's parliamentary system of democracy requires a legislative framework for an executive action to operate as an operating norm. The Supreme Court, in *Re Delhi Laws Act* Case, held that delegated powers must remain under legislative control and cannot amount to abdication of essential legislative functions. Indian National Space Promotion and Authorisation Centre (IN-SPACe) was established in 2020 by the Union Cabinet to promote and facilitate private sector participation in the space sector, which acts as a nodal agency and autonomous body within the Department of Space (DOS). The ISP, among other things, envisages and elaborates on IN-SPACe's functioning, but this was done almost three years after IN-SPACe came into existence. Since the ISP is merely a policy document, not a law or legislative enactment, the credibility of IN-SPACe is questionable. IN-SPACe, being a regulatory body that grants authorisations without possessing its own legal authority, relies on the Department of Space and ISRO to conduct its operations. Hence, many private players now also take approval from the government ministries after receiving provisional authorisation from IN-SPACe.

The power to legislate on 'space' falls with the Union under the Residuary List, according to Article 248. Hence, an executive policy on this subject matter without a statute is constitutionally questionable. This absence of legislative backing translates into weaknesses in enforcing India's obligations under international treaties such as the Outer Space Treaty and the Moon Agreement. Article VI of the Outer Space Treaty and Article 14 of the Moon Agreement place international responsibility for governmental and non-governmental activities on the Moon, and the activities to be carried out under the 'authority and continuing supervision' of the appropriate State party. They do not specify the frameworks under which 'authorisation and supervision' must be carried out. Domestic legislation is expected to address this by providing detailed governing frameworks for their functioning, particularly given the greater risk associated with space activities, which burden the state exchequer. Further, authorising does not merely include executive authorisation, but also a legal regulatory approval, which requires legislative backing.

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Hence, the ISP alone may not satisfy the obligation to authorise and supervise under the Outer Space Treaty and the Moon Agreement, severely compromising India's position with respect to their implementation and thereby violating a fundamental treaty obligation.

ISP's Resource Extraction and the Moon Agreement

The primary point of conflict between the ISP and the Moon Agreement concerns resource extraction by private actors. Clause 4(13) of the ISP encourages non-governmental entities (NGEs) to engage in the commercial recovery of an asteroid resource or a space resource and entitles them to the right to "possess, own, transport, use and sell any such asteroid resource or space resource". This conflicts with Articles 4(1) and 11 of the Moon Agreement, which strongly oppose the individual commercialisation of the Moon and celestial bodies. Article 4(1) of the Moon Agreement notes "The exploration and use of the moon shall be the province of all mankind... for the benefit and in the interests of all countries...". Article 11 of the Moon Agreement declares that the Moon and its natural resources are the Common Heritage of Mankind (CHM).[1] It imposes mandatory benefit-sharing obligations on countries, in stark contrast to private property rights to possess, own, and sell space resources.

Article 11(3) prohibits the creation of property rights on the "surface or the sub-surface of the Moon, nor any part thereof or natural resources in place" of the Moon. Some scholars have argued for an interpretive distinction between ownership of extracted resources and ownership of celestial territory. Domestic law frameworks that promote commercialisation have supported such interpretations. Others have noted that domestic frameworks, especially that of the United States, fail to achieve their goal of providing security for private entities because they conflict with international legal obligations. Clause 4(13) of the ISP, which provides a property-centric understanding of the space resources on the moon, is at odds with Article 11(3) of the Moon Agreement. The mere assertion that the mining should be 'in accordance with international obligations' both under the ISP and the Norms, Guidelines and Procedures (NGP) 2024 for Implementation of Indian Space Policy-2023 does not resolve the legal question on the permissibility of extraction and ownership rights. As Professor Sandeepa Bhat B. enumerates, Clause 6(7) of the ISP

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also encourages ISRO research on extraterritorial habitability, which raises additional questions about land rights on celestial bodies.

While the Outer Space Treaty prohibits national appropriation, it explicitly allows for the 'exploration and use' of outer space. Scholars supporting space resource mining argue that the prohibition is specifically against sovereign appropriation and creation of titles, and not against the creation of property rights. Article II of the Outer Space Treaty uses the phrase "by any other means". This is a catch-all phrase deliberately designed to run counter to an exhaustive definition, to ensure that grounds like this will not be raised later. The Moon Agreement goes a step further, and Article 11(2) states that the Moon is not subject to national appropriation. Article 11(3) supplements this to avoid individual property rights and leads the way for collective rights to be established under the international regime for utilisation of resources stipulated in Article 11(5). Hence, the permission to 'use' under the Outer Space Treaty shall not be misconstrued to allow individual property rights over celestial resources.

A distinction between ownership of extracted resources and direct property rights is also often used to argue that space mining and similar activities fall outside the scope of the non-appropriation principle. But a basic principle of property law is that a right to sever a resource from the land and acquire property rights over it can exist only when there is an antecedent right to the land itself. However, both the Outer Space Treaty and the Moon Agreement declare the application of common rights principles, such as the province of all mankind and CHM, respectively. This is further supported by the drafting history of the Moon Agreement, in which future resource extraction was a point of discussion and a reason for theorising the CHM principle. Hence, this claim of right to the extracted resource cannot exist when there is no right to the land itself. Scholars note that the right to extract natural resources is generally viewed as an incident of ownership or another recognised proprietary estate, not as an independent entitlement standing apart from territorial rights. While principles of domestic land law systems cannot be directly transposed into international outer space law, this provides a logical explanation for why the separation of resources as a subject cannot be automatically assumed, nor is it either practically feasible or doctrinally uncontroversial.

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Additionally, an argument for extending countries' jurisdiction is that Articles VI and VIII of the Outer Space Treaty and Articles 12 and 14 of the Moon Agreement permit States to regulate and protect the activities of private actors engaged in mining in space without claiming sovereignty. These provisions establish regulatory jurisdiction and do not extend to property rights in the resources of the *res communis*. Hence, such an argument is devoid of any merit.

Indian Obligations under the Moon Agreement: A VCLT Perspective

India has not yet ratified the Moon Agreement, meaning it has not entered into force vis-à-vis it. According to Article 18(a) of the Vienna Convention on Law of Treaties (VCLT), States are not required to ensure full compliance with the treaty obligations, but they have to refrain from acts which would "defeat the object and purpose of a treaty", until they make clear their intention not to become a party. Article 18(b) applies this obligation, "pending the entry into force of the treaty", when it has expressed its consent to be bound by the treaty. This provision is the 'interim obligation' under the VCLT, intended to bridge the gap between signature and ratification. It requires compliance with the treaty's *raison d'être*, expressed in a reduced form rather than its substantively specified obligations, and seeks to bridge the gap between the conclusion and entry into force of treaties.[2] As Dörr stated, the European Court of First Instance in *Greece* v. *Commission* in 2007 described it as a codification of the good-faith principle. As enumerated by Rydberg, Article 18 forms a codification of customary international law, applying to States irrespective of their status in conjunction with the VCLT.

It is prudent to mention here that while Article 18(a) is considered to be in place after a signature or exchange of a treaty by a State has taken place, Article 18(b) applies when there is expressed consent to be bound by the Treaty. Article 18(b), according to many, generally applies after the ratification, accession or approval, when the treaty has not 'entered into force'. That is why both sub-clauses are included to ensure that the object and purpose of a treaty are not defeated, although 18(b) might have a stronger chronological foundation. The relevance of Article 18 in the context of longstanding unratified international legislation, such as the Moon Agreement, becomes even more apparent, as it serves as a restraint on a State continuing to pursue policies that run counter to the Treaty's fundamental purpose. Inversely, it is stated that the vagueness of the 'object and purpose' of a treaty renders

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the precise scope of this interim obligation incalculable. As Paul Gragl states, Article 18 of the VCLT also has legitimate concerns for being ambiguous as it "neither defines nor determines its own contours". However, it is certain that the continuation of India's status as a signatory invites a legal inquiry into the compatibility of its space policies and frameworks with possible obligations.

The Temporal Question

The temporal scope of Article 18 of VCLT remains contested as the Moon Agreement entered into force in 1984. This is particularly important when analysing the ISP 2023, as it raises the question of whether Indian obligations still stand under Article 18 of the VCLT, after four decades since the Moon Agreement entered into force. If Article 18 obligations stand, that would mean the assessment of the policy must take additional considerations into account, and the object and purpose of the Moon Agreement must be taken into account. The interim obligation, if considered to have lapsed, would not affect the seismic shift the ISP has made towards private-sector participation, including the establishment of a regulatory framework.

The first interpretation under Article 18 is that 'entry into force' is the general entry into force of the treaty after the minimum number of ratifications is made. This interpretation of the status of an obligation under Article 18 assumes that the intent of this provision is to ensure the integrity of the treaty when it is not yet effective, not when it has entered into force. Therefore, the obligation to respect the 'object and purpose' applies only for the period before a treaty has entered into force.[3] Nevertheless, a widely challenged alternative to this reading is one that is more aligned with the structure and overall scheme of the VCLT, particularly Article 18. It is that the term 'entry into force' in Article 18 means when the treaty enters into force as to the particular State concerned, rather than when the treaty enters into force generally. Therefore, the interim obligation continues until it either ratifies or provides some unambiguous intention not to become a party to the treaty. The phrase 'entry into force' in Article 18(b) clearly provides that a State's accession to an already open treaty is within the parameters of Article 18(b), and thus can be interpreted to mean that the term 'entry into force' refers to the entry into force with regard to the particular State concerned. For this, 'entry into force' across the provision must be read as State-specific and reading otherwise would render Article 18(b) redundant. Additionally, the object and purpose of Article 18 is to ensure that

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States do not act in bad faith from the moment they sign a treaty until the moment they assume or undertake their obligations under it. As rightly mentioned by Shabtai Rosenne, the VCLT applies *ex nunc*, meaning from the time of its adoption, and there is no other specific temporal limitation, meaning it should stand.

Article 18(a) extends only 'until the State shall have made its intention clear not to become a party', requiring a sufficiently formal declaration of intent. The obligation cannot be presumed to be terminated simply because a State has done nothing or acted ambiguously. Most legal commentaries support an interpretation of State-specific obligations. State practice can also be seen in relatively recent examples, such as the United States signature of the Rome Statute in 2000, which led to the application of the interim obligation until the United States informed in 2002 that it did not intend to become a party. As stated by scholars, if the United States had not done so, it would have been subject to the rather vague restraints under the VCLT. India has not issued such a declaration regarding the Moon Agreement; therefore, it has not terminated its interim obligations under Article 18(a). Thus, India, as a signatory to the Moon Agreement, remains bound by Article 18(a) of the VCLT.

Object and Purpose of the Moon Agreement and ISP

Several international bodies have attempted to define the 'object and purpose', though none has provided a direct definition. The International Court of Justice (ICJ) has sought to balance a country's sovereign right to make reservations with the integrity of the treaty.[4] In the *Reservations to the Convention on the Prevention and Punishment of the Crime of Genocide* case, the ICJ stated that a reservation to a treaty cannot be against the "object and purpose" of the treaty, but does not define it. The Guide to Practice on Reservations to Treaties, 2011, by the International Law Commission, in guideline 3.1.5.1, provides guidance on determining a treaty's object and purpose. It states that the primary determination is to be made on the basis of the treaty's terms, preamble, and title. Additional recourse may be taken in light of the circumstances, such as preparatory work, the conclusion, and subsequent State practice.

Following logically, one of the primary reasons for enacting the Moon Agreement was to establish the legal regime governing the natural resources of celestial bodies. More significantly, the purpose underlying the Moon Agreement is that of equitable benefit-sharing, so that developed countries do not reap all the benefits. The

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Preamble of the Moon Agreement establishes its purpose as dealing with the possible commercial utilisation and regulation, which is reflected in the explicit enumeration of "benefits which may be derived from the exploitation of the natural resources of the moon and other celestial bodies". This is followed by a detailed regime for CHM under Article 11 of the Moon Agreement. As most other parts of the Moon Agreement are the reflections of the Outer Space Treaty provisions, scholars like Von der Dunk and Laura Delgado-López have argued that the regulation of resource exploitation and benefit-sharing are core objectives of the Moon Agreement.

The Moon Agreement's CHM principle expands the *res communis* framework by making equitable benefit-sharing mandatory and applies to resource extraction. While the *res communis* doctrine grants everyone a right, it does not require anyone to share benefits. The principle of CHM goes beyond voluntary participation in benefit-sharing under Article I of the Outer Space Treaty, calling for the mandatory and equitable sharing of benefits. In addition, the international management system is an essential part of the CHM to prevent assertion of monopoly rights and to ensure benefit sharing. Although the acceptance of the CHM principle in space law has been debated and the Moon Agreement has consequently been viewed as unsuccessful, the signatory States' responsibility for benefit-sharing and their submission to an international management system, as the major objectives of the Moon Agreement, cannot be denied.

The recent developments, such as India's accession to the Artemis Accords and the promulgation of the ISP, are at odds with the object and purpose of the Moon Agreement. The Artemis Accords, catering to the interests of a select few States, are not to be misconstrued as an international management system stipulated under the Moon Agreement. It is a United States-dominated interpretation of the Moon Agreement's obligations, and it must be rejected to protect the Moon Agreement's purpose by establishing a multilateral framework. The ISP, as a commerce-oriented policy, is an individualistic approach to exploiting celestial resources. In addition, it does not include any provision for the sharing of benefits derived from the exploitation of common resources of celestial bodies. Thus, it stands at loggerheads with the object and purpose of the Moon Agreement.

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Conclusion

Based on the above analysis, the authors draw two conclusions. Firstly, India has obligations under the Moon Agreement pursuant to Article 18 of the VCLT. Secondly, the provisions of the ISP 2023 are in direct contrast to such obligations and run counter to the object and purpose of the Moon Agreement. Whether India will move forward with withdrawing from the Moon Agreement or enable positive changes to the ISP and bring in the much-needed domestic legislation is yet to be seen. Nonetheless, India should have demonstrated more caution while signing the Artemis Accords and enacting the ISP. Rushing into regimes and creating domestic laws that support and promote the exploitation of space resources, especially by private players, might not be as beneficial to India as it appears and may even be counterproductive, as private entities from other spacefaring nations with established space credentials may outweigh Indian players. Policies of spacefaring powers like India would significantly shape how space resource utilisation proceeds and how developing countries will stand in this new era of the space race. Hence, India needs to lead the way with laws and policies aligned with the Moon Agreement to shape commercial space activities and ensure equitable outcomes.

Notes and References:

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THE INDIAN ICARUS: SHORTCOMING IN ADDRESSING AIRCRAFT ACCIDENT INVESTIGATION RECOMMENDATIONS

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Abstract

The article examines implementation gaps of the aircraft accident investigation recommendations within the Indian region by analysing four accidents spanning over three decades (1990 Bangalore Crash, 2000 Patna Crash, 2010 Mangalore Crash and 2020 Kozhikode Crash). The study demonstrates that these incidents were not isolated events but rather the result of recurring infrastructural and regulatory failure. The legislative scope of the paper is located within Annex 13 of the Chicago Convention on International Civil Aviation (ICAO), and in the Indian context, it can be derived from Bharatiya Vayuyan Adhinayam 2024 and the Aircraft (Investigation of Accidents and Incidents) Rules 2025. By analysing the aforementioned accident reports and their recommendations, of crashes post 1990, the article tries to identify a pattern of non-compliance with safety recommendations, and how such failure in consideration resulted in the repetition of accidents arising from similar or identical circumstances. The authors argue that recommendations are often reduced to mere formality due to the non-existence of a binding implementation mechanism. The paper ends with suggestions on structural reforms to fix this problem.

Keywords: Aircraft Accident – Annex 13 – Bharatiya Vayuyan Adhinayam – Crash Reports – Indian Aviation Industry – Rules 2025

Introduction

The final words "*We don't have a runway left*." were the last words of Harbinder Singh Ahluwalia, the First Officer of the Air India Express Flight IX-812, which overran the tabletop runway at Mangalore in 2010, resulting in the loss of 158 lives. The Mangalore Crash is seen as one of the deadliest aviation disasters in India.

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With approximately 350 million annual air passengers, India is the third largest aviation market in the world, as per the Ministry of Civil Aviation's Budgetary Report for 2025-2026. The Indian aviation market is estimated to grow at 10-12% annually. Despite this growth, aviation safety governance in India continues to lag behind international best practices. As of 2024, about 11.9% of India's population travels by air, yet even within this relatively limited user base, safety measures and operational standards often fail to meet the benchmarks prescribed by the International Civil Aviation Organisation (ICAO). The Indian concerns have been on the runway design and standards; air traffic management and air traffic infrastructure; failures of regulatory oversight and enforcement; and aircrew management protocols. Some of their issues, as listed, raise questions about the rational choice of adoption of standards and institutional structures, and of institutional responses.

In accordance with the mandates prescribed in Annex 13 to the Chicago Convention on International Civil Aviation (hereinafter, Annex 13), the Aircraft (Investigation of Accidents and Incidents) Rules 2025 (hereinafter, Rules 2025) govern serious incidents and accidents involving aircraft. The process for investigating accidents or incidents involves a detailed examination of the factors and verification of compliance with the standards. The report prepared captures one crucial aspect, which is safety recommendations. Although these safety recommendations are designed to explicitly address the root cause of the accident to prevent repetition, both regulatory bodies and industry players often fail to ensure their comprehensive implementation.

In light of these circumstances, this article examines India's aviation safety governance, particularly focusing on the regulatory inertia or financial inabilities that impede the implementation of these recommendations. This analysis is structured in three parts. The first part of the paper examines the current legislative and regulatory framework whilst identifying the gaps that contribute to the above-mentioned inertia. The second part analyses the four major aviation accidents by highlighting the patterns which caused the recurrence of the accidents and how the timely implementation of the recommendations could have prevented the fatalities. The last part of the paper proposes certain reforms aimed at enhancing the current safety regime.

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Governing Statutory Framework

The legislative framework for aviation safety can be derived from two overlapping realms of governance: the international aviation safety regime (Chicago Convention and its Annexes) and Indian domestic laws and regulations.

International Framework

The International framework governing aircraft accidents and investigations is situated within Annex 13 and is supplemented by the Manual on the Regional Accident and Incident Investigations Organization (RAIO). Together, these instruments establish the procedure for conducting investigations and considerations for formulating safety recommendations to prevent the recurrence of accidents.

Annex 13 prescribes detailed Standards and Recommended Practices (SARPs) for accident and incident investigation, with Chapter 8 specifically addressing preventive measures. Clause 8.6, titled "Safety Recommendations", provides that where preventive actions are identified to address actual or potential safety deficiencies, the concerned State is expected to implement such actions or establish mechanisms to monitor both their implementation and effectiveness. This provision shifts the perspective from attribution of blame to systemic risk mitigation. Further, Clause 8.8 advances this preventive mandate by emphasising the importance of safety-oriented research and systemic evaluation, by encouraging States to engage in continuous assessment and improvement of safety performance across their aviation sectors.

Complementing Annex 13, the Manual on RAIO elaborates on institutional responsibilities at a regional level. Clause 5.5 of the Manual outlines the manner in which safety recommendations are to be processed, requiring a RAIO to establish clear policies and procedures for their implementation. It further envisages the creation of dedicated bodies or the assumption of direct responsibility to monitor compliance with and follow up on safety recommendations, thereby reinforcing institutional accountability.

The robust framework and the effort of the ICAO are aimed at ensuring that no country is left behind in compliance with aspects of aviation safety. However, the

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focus of no country left behind is just a hand-holding approach, and concerns about ICAO's lack of enforcement power to compel compliance[1] mean that mandates remain a paper tiger. The Annex 13 mandates have, in fact, been very poorly implemented by States, and in many cases, such poor implementation is attributed to a lack of finances, infrastructural inadequacies or administrative difficulties are cited as reasonsnon-compliance. This inconsistency between international instructions and local implementation seriously weakens the preventive role of accident investigation and simultaneously exposes structural deficiencies of the global aviation system.

Adoption of safety norms in the form of SARPs at the domestic level has a unique challenge of lack of uniformity, as there are pre-existing infrastructure constraints; however, in newer airports, the SARPs cannot be disregarded since the aspect of fresh construction gives them an opportunity to incorporate the guidelines. The safety norms have evolved over a period of time based on experiences and past incidents. The central idea of safety norms was that the absence of safety measures is unacceptable, and even if the mandates prescribed by ICAO are not followed, there has to be an alternate measure. Aircraft accident investigation recommendations (AAIR), if any, should come with a direction to implement them; however, there has been a lackadaisical approach in some jurisdictions.

Domestic Framework

The Bharatiya Vayuyan Adhinayam 2024 (hereinafter, Act) largely mirrors the framework of the Aircraft Act 1934, introducing only limited substantive modifications. Its relevance in this context is largely confined to Sections 10 and 11, which authorise the Central Government to frame rules for carrying out the purposes of this Act and to implement international Standards and Recommended Practices governing the operation of aircraft, respectively. Further, the legislation continues the statutory constitution of the Aircraft Accidents Investigation Bureau (AAIB) under Section 7 to investigate and formulate recommendations in cases of accidents. Under this Act, the Rules 2025, which replace erstwhile 2017 rules, constitute the primary instrument governing accident investigation and safety recommendations.

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The Rules 2025 explicitly stipulate that the objective of the investigation is solely to prevent future occurrences and not to apportion blame or liability on anyone. Structuring this framework are necessary statutory definitions, including "accident" under Rule 2(1) and "Safety Recommendations" under Rule 2(31). Under Rule 9(1)(f), the investigating authority is empowered to issue safety recommendations derived from periodic safety studies, specifically encouraging the inclusion of novel risk-mitigating technologies. However, these progressive statutory mandates frequently fall short during execution owing to bureaucratic hurdles.

Major Aircraft Crashes

Under the 2025 Rules, an 'accident' is defined by magnitudes of impact, restricting the term to incidents resulting in loss of life, severe injury, substantial structural compromise or aircraft disappearance. While aviation safety has evolved, a historical analysis reveals that a significant proportion of accidents within the Indian Flight Information Region were fundamentally preventable.

Since investigation reports prior to 1990 are unavailable, this study focuses on the recent crashes to identify the pattern of organisational and safety deficiencies. While the primary factors causing these accidents were deemed either to be meteorological or pilot errors, the underlying systemic reasons remain under-examined. It is to be noted here that the failure to implement earlier safety recommendations contributed to the occurrence of subsequent, and largely preventable, crashes. In this context, the four major crashes; Indian Airlines - Airbus 320, Bangalore (1990), Alliance Air - Boeing 737 - 2A8, Patna (2000), Air India Express - Boeing 737-800, Mangalore (2010) and Air India Express - Boeing 737-800, Kozhikode, (2020) require a focused study. References have also been made to the Imphal and Aurangabad accident; however, the authors have excluded the Charkhi Dadri collision since it involved two foreign airlines. These cases spanning over three decades serve as a representative benchmark for evaluating the persistence of active failures and latent conditions within the Indian regulatory and operational framework, which caused these accidents.

On 14 February 1990, Bangalore Airport witnessed a major crash, when the Indian Airlines Airbus A320, crashed during its final descent, causing 92 deaths. The accident

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report attributed the accident to the crew's inadvertent selection of 'open-descent' (flight idle) mode over the 'Glide Scope Capture' mode; this error in the automation management caused the aircraft to sink dangerously below the flight path despite radio altitude warnings. Similarly, in the 2000 Patna crash, the crew's inability to maintain a stabilised approach led to the aircraft being 'high on approach' with engines at idle, resulting in the loss of 60 lives. While the Bangalore crew failed to respond appropriately to altitude callouts, the Patna crew mistakenly started a Go-Around rather than the required 'Approach to Stall Recovery'. In both cases, the crew's failures to use resources and lack of situational awareness were the primary causes of fatal accidents. These accidents further show a trend in which the pilot's decreased technical ability resulted from inadequate control of the aircraft's energy level and the automatic flight control system used during the landing phase.

A comparison of the two investigation reports shows that they intersect on a series of safety requirements, mainly on the need for strong Crew Resource Management (CRM) and stricter adherence to Standard Operating Procedures (SOP). To minimise human risk factors, both investigations identifies insufficient pilot training and recommended the enhancement of stall-related awareness and recovery techniques. Such similarity in recommendations pointed to the underlying system-level flaws as the cause of these aviation disasters, which went beyond mere 'flight deck management'. The Bangalore investigation highlights the danger of ineffective airport layouts, while the Patna investigation reported incompetence in spare part handling and flawed maintenance of the navigation system.

A comparative analysis of these investigations reveals a pattern; the low safety margins, substandard airport infrastructures, and hazardous topographical constraints created a dangerous approach condition at both Bangalore and Patna airports. Further, the 1990 Bangalore Report had already recommended the expansion of runway safety areas and the modernisation of navigational aids. If these recommendations had been enforced promptly across all category airports, the Patna disaster that occurred a decade later could have been prevented.

To better examine the structural flaws of this period, it is necessary to examine the two intermediate accidents at Imphal (1991) and Aurangabad (1993). The 1991

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Imphal disaster, resulting in 69 deaths, served as an illustration of non-adherence to SOP and cockpit hierarchy flaws. As per the report, the Pilot-in-Command's deviation from the flight plan caused a complete loss of situational and time awareness during the approach. This lapse was further exacerbated by 'terrain over-familiarity'. The accident was mainly attributed to poor CRM, as the First Officer failed to actively intervene or challenge the Pilot-in-Command's deviation.

Similarly, the Aurangabad disaster on 26 April 1993 was attributed to a combination of pilot errors and regulatory oversight failures by the Airport authorities. The investigation cited the delay and improper rotation technique by the pilot during the takeoff as one of the primary causal factors. In addition to this failure, the Airport authorities failed to clear vehicular traffic on the perimeter of the airfield, causing the aircraft to collide with a moving lorry on a roadway adjacent to the runway end. This accident resulted in 55 deaths, including 53 passengers and 2 cabin crew members.

Though it may be argued that the brief intervals between the Bangalore crash and subsequent events at Imphal and Aurangabad left a very narrow window to implement the recommendations, no such defence can apply to the Patna disaster. Occurring nearly ten years after the Bangalore report, Patna stands as a prime example of regulatory inertia.

The lack of urgency with regard to implementation is blatantly visible from the fact that several important safety measures, particularly those concerning the Patna Airport, were only fully resolved in 2022, after a long 22 years wait. Rather than serving as a catalyst for active reform, investigative reports end up as post-mortem documents. One of the main causes for this lag in implementation is the tolerance towards bureaucratic lethargy.

The 2010 Mangalore tragedy, where an Air India Express Boeing 737-800 overran the table-top runway and plunged into a gorge, subjected the enforcement failures to severe scrutiny. The investigation realised that a severely unstable approach coupled with the commander's physiological impairment, specifically his severe sleep inertia induced by long mid-flight sleep, was the main cause of the accident. Despite three explicit 'go-around' callouts from the First Officer, a rigid cockpit hierarchy

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neutralised the corrective intervention, resulting in a late touchdown that exhausted the remaining runway. The accident was further aggravated by infrastructure non-compliance at Mangalore Airport, such as the presence of the non-frangible Instrument Landing System structure and the Runway End Safety Area (RESA), which could likely have absorbed majority of the impact. The plane's dive into the gorge, causing 158 fatalities, exemplified the Swiss Cheese model of accident causation. Further, the lack of medical examination of the pilot at the Airport played a huge role in the happening of this disaster.

The infrastructure characteristics of Mangalore International Airport indicate a departure from ICAO safety norms. The Mangalore Airport has repeatedly faced criticism for not following safety regulations, but this feedback has largely been ignored. This indicated the regulator's clear disinterest in implementing the recommendations. The assertion is demonstrated by the Kozhikode accident, where ten years later, on 7 August 2020, an Air India Express Boeing 737-8HG involved in the Vande Bharat repatriation mission fell into a gorge at the Kozhikode Airport due to poor weather, specifically heavy rainfall and strong tailwinds, resulting in 21 fatalities.

Both investigation reports clearly highlighted the need for compulsory cockpit and CRM training backed by regular refresher courses combining classroom teaching with simulator exercises. Despite classroom training, the strict cockpit hierarchy continues to be the primary reason for the unsuccessful application of the CRM training. This gap reflects the DGCA's inability to extend CRM training beyond the classroom setting. The Mangalore investigation also suggested implementing Engineered Material Arresting Systems (EMAS) as a substitute for the present rigid concrete barriers or using a Runway Overrun Awareness and Alerting System, as a way to ensure safer runway end safety. The lack of implementation indicates that the investigation reports are turned into mere post-facto records instead of valuable tools for aviation safety.

Procedural non-compliance and regulatory deficits fundamentally compromised safety across these case studies. In the Mangalore crash, inadequate crew preparation and the omission of mandatory pre-flight medical screening directly violated the

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safeguards designed to mitigate pilot fatigue, highlighting flaws in CRM and SOP. Similarly, the Bangalore and Patna crashes were caused mainly by infrastructural deficiencies such as the absence of ILS, an instrument which could have helped pilots' situational awareness. The most recent Kozhikode accident advised a revision of risk management and safety oversight programmes. Collectively, these occurrences demonstrate that aviation accidents are rarely isolated incidents but rather represent a failure by the system to implement ICAO safety standards.

Reform Proposal

The Indian aviation safety regime needs a transition from a reactive to an active paradigm, necessitating the establishment of bodies such as the Independent Supervisory Body (ISB), which shall be tasked with the mandate of supervising and implementing safety recommendations. The ISB should be largely inspired by the United States' National Transport Safety Board's (NTSB) tracker, wherein the body is statutory with the power to actively monitor compliance, enforce implementation deadlines, and maintain a publicly accessible safety database. One of its essential features is the implementation of a 'Reasoned Justification' mechanism, which legally obligates the competent authority to submit a comprehensive, evidence-based written explanation whenever a safety recommendation is rejected or partially adopted. This proposal aims to protect against bureaucratic inertia and regulatory delays.

Further, the systemic use of budgetary constraint as an excuse for subpar infrastructure or regulatory ignorance is no longer acceptable. Treating safety infrastructure as an optional expenditure reduces the State's commitment to passenger well-being, especially considering the enormous financial resources now provided by the Union of India to the civil aviation sector, owing to its new UDAAN scheme. To address this, ring-fenced funds should be institutionalised as a special budgetary allocation for carrying out accident investigation recommendations. Additionally, the State can promote healthy competition and create sustainable revenue streams required to support this long-term safety investment without jeopardising public funds by implementing a comprehensive National Aviation Safety Policy, which shall address organisational deficiencies in pursuing privatisation of airports.

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Finally, providing ICAO with a more comprehensive supervisory role can improve the efficacy of safety governance on a global scale. The current regime provides ICAO little room to ensure enforcement, in cases of non-compliance with recommendations, and one of the suggested possible measures can be to rely on Article 94(b), which provides for the organization to expel States from ICAO if they do not ratify certain amendments to the Chicago Convention. However, such measures may purely create social pressure with no institutional repercussions, as States can enter into arrangements with other States to continue air operations. An alternate approach would be to establish standards that neither provide room for negotiation nor cause financial or operational burdens. In this system, contracting States should be required to establish formal and time-bound mechanisms for the consideration of safety recommendations. It shall entail a strict 'twelve-month' rule, requiring States to provide a formal acceptance and reason for partial acceptance and rejections. ICAO should ensure that States shall employ a body to oversee such an implementation. Taken together, these domestic and international reforms would promote a more accountable and effective aviation safety framework.

Conclusion

The principal weakness of India's aviation safety regime lies not in the investigation of aircraft accidents, but in its failure to implement safety recommendations. Through a comparative analysis of four major aircraft accidents spanning over three decades, it is found that repeated tragedies are a result of bureaucratic inertia and the absence of a binding implementation mechanism. The effectiveness of Annex 13 cannot be assessed solely by the quality of the investigation but must also be measured by its usefulness in the prevention of accidents. Unfortunately, the Indian aviation framework, with inherent regulatory gaps, has underperformed in this regard. Accident investigation reports can fulfil their preventive purpose only when their recommendations translate into useful implementations. Hence, establishing ISB, introducing a time-bound compliance mechanism, and ensuring greater transparency in monitoring implementation are of great significance for improving aviation safety in India.

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